Biochronology of Cambrian phytoplankton

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The global cumulative record of Cambrian phytoplankton is estimated to exceed 350 morphospecies and is compiled from the marine shelf and intracratonic successions from almost all known palaeocontinents during the time. In this account, the acritarch microfossils, representing unicellular, autotrophic protists of prasinophycean, chlorophycean and probable other algal affinities, are considered. Their abundant record derives from predominantly siliciclastic deposits, but also carbonates, cherts and phosphorites, accumulated in various depositional environments.

Acritarchs have undergone fast evolution during the Neoproterozoic and early Palaeozoic, in particular Cambrian, times. The radiation and extinction rates during Cambrian, and in general increased tempo of speciation, are estimated from comprehensive occurrences within discrete biochrons. The duration of acritarch and time-equivalent faunal biochrons has been calculated to 2-5 Ma, and is based on isotopic age determinations of rock units comprising diagnostic assemblages. The appreciation of Cambrian phytoplankton diversity is increasingly accurate, owing to recent re-evaluation of taxonomy and stratigraphic ranges of numerous taxa and better resolution of the global geochronologic frame. Although various stages and/or informal segments of the Cambrian successions are unequally studied and the micropalaeontological record is biased, the consistent taxonomic fluctuations and replacements of phytoplankton associations between individual biochrons are well recognised. The pattern of acritarch biodiversity changes has been utilised to define several biozones throughout the system (Volkova *et al.,* 1983; Welsh, 1986; Volkova 1990; Moczydlowska 1991, 1998; Molyneux *et al.,* 1996), which are set in relation to trilobite biozones. Based on the established time equivalence, the acritarch and faunal biozones, and corresponding biochrons, can be used alternatively for more universal biochronology. It is obvious, however, that the time span of particular biochrons is of a different length.

The evolutionary changes coincide frequently with major geological events such as sea level rise and fall, tectonic movement and deformation, glaciation and other and climatic fluctuations. The comaparison of the contemporaneous Cambrian geo- and bioevents that occurred in short time intervals (a few million years) strongly supports the idea that many of the recorded evolutionary changes were caused by the environmental factors. The biotic and environmantal interactions are intrinsic, however, judging from the fossil record to what extent the environmental changes have influenced evolutionary innovations or how the biota have affected the environments remain uncertain.

A new case study of the acritarch-based biochronology of the Cambrian in the Baltica palaeocontinent provides an evidente that the earliest appearance of trilobites, or at least their wide palaeogeographic distribution, was probable contemporaneous in Baltica and at the Armorican margin of Gondwana (the Iberian Península), coinciding in time with the second early Cambrian acritarch biochron, the *Skiagia-Fimbriaglomerella* Biochron, which is time-equivalent to the *Schmidtiellus mickmitzi* trilobite Biochron (Moczydlowska, 1999; Vidal et al., 1999; Moczydlowska et al., in prep.)

New records of acritarchs and olenellid trilobites have been studied from the autochthonous Lower Cambrian successions along the Caledonian Thrust Front in northem Sweden. The fossils are from a newly examined natural outcrop at Bergmyrhobben near Lake Storuman, and from the outcrops previously known to be fossiliferous at Delliknas and Mt. Assjatj, the Laisvall mine and the Maiva borehole successions in the Laisvall area. The phytoplankton assemblages are recorded throughout the Grammajukku Formation and are age diagnostic for the *Skiagia-Fimbriaglomerella* acritarch Zone (the lower part of the formation), and the *Heliosphaeridium-Skiagia* acritarch Zone corresponding to the Holmia kjérulfi trilobite Zone (the upper part of the formation). The acritarch record from the Storuman area documents the presence of strata contemporaneous to the Schmidtiellus mickwitzi Zone for the first time in the Scandinavian Caledonides. This zone was previously recognised in the platform regions of the Baltica palaeocontinent. The trilobite fauna, attributed tentatively to Holmia sp. though probably representing a new species, occurs at the lowermost stratigraphic level among olenellids in the Caledonides. The range of this species, estimated from the concurrent acritarchs biochronology, is within the *Schmidtiellus mickwitzi* Zone.

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